

# TOS9213AS

Hipot Tester with Insulation Resistance Test

**For the insulation testing of PV(Photovoltaic) module**



## TOS9213AS(DCW/IR)

GPIB

RS232C

**Accompanied with the features and performance of TOS9200 series, and it extends additional features and specifications exclusively applied to the PV module testing.**

The TOS9213AS, DC Withstanding Voltage/Insulation Resistance Tester, is the test instrument that can handle the insulation test with high voltage and high resolution required for the evaluation of the PV module, Cable, Connector, and Junction Box. The TOS9213AS is equipped with functions of the DC withstanding voltage testing and the insulation resistance testing accompanied with the features and performance of Kikusui's high-end model TOS9200 series, and it extends additional features and specifications exclusively applied to the PV module testing. Furthermore, the TOS9213AS improves the current measurement accuracy of the DC withstanding voltage testing from the original specification of the TOS9000 series.

- Up to 10 kV / 5 mA with a maximum output of 50 W in DC withstanding voltage test
- Perform insulation resistance testing in the range of -25 V to -1500 V / 0.01 M to 9.99 G
- Applies for the testing of IEC61730-2 standard
- High-precision current measurement, 1  $\mu$ A of the setting resolution for judgement
- Low output ripple of 100V p-p at 10 kV with consideration of capacitive load
- Capable of setting voltage rise rate by Rise Time Control Function, equipped with Discharge Function
- Capable of converting judgements of insulation resistance test into values of resistance and current
- Capable of applying high voltage and monitoring current for PID symptom (-1500 VDC / 100  $\mu$ A)

# TOS9213AS

## Hipot Tester with Insulation Resistance Test

### Hipot Tester

Output section(DC)		
Output-voltage range	0.05 kV to 10.0 kV DC	
Resolution	10 V	
Accuracy	±(1.5% of setting +20 V)	
Maximum rated load *1	50 W (10 kV/5 mA)	
Maximum rated current	5 mA	
Ripple	No load at 10kV: 100 Vp-p Typ. Maximum rated load: 100 Vp-p Typ.	
Voltage regulation	1% or less [maximum rated load → no load]	
Short-circuit current	40 mA Typ.	
Discharge function	Forced discharge at the end of test (discharge resistance: 500 kΩ) The discharge time can be set to a value from 0.5 s to 300 s. (*2)	
Start voltage	The voltage at the start of the test can be set as the start voltage.	
Setting range	0% to 99% of the test voltage (resolution of 1%)	
Output-voltage monitoring function	If the output voltage exceeds ±(10% of setting + 50 V), output is cut off and the protection function activates.	
Voltmeter		
Analog	Scale	10 kV AC/DC F.S
	Accuracy	±5% F.S
	Indicator	Mean-value responsive
Digital	Measurement range	0.0 kV to 10.5 kV DC
	Resolution	10 V
	Accuracy	±(1.0% of reading + 20 V)
	Response	Mean-value responsive (response time of 200 ms)
HOLD function	The voltage measured at the end of test is held during the PASS and FAIL period.	

\*1: Limitation on output

The tester's withstanding voltage generator is designed to radiate half as much heat as the rated output, in consideration of the size, weight, cost, and other factors of the tester. It is therefore necessary to use the tester within the ranges specified below. Operations deviating from these ranges may heat the output section excessively, thereby activating the protective circuit. In such a case, suspend the test and wait until the temperature falls to the normal level.

#### Output limitation in withstanding voltage testing

Ambient temperature	Upper reference	Pause	Output time
t ≤ 40 °C	DC	2.5mA < i	At least as long as the output time Maximum of 1 minute
		i ≤ 2.5mA	At least as long as the judgement wait time (WAIT TIME) Continuous output possible

[Output time = voltage rise time + test time + voltage fall time]

\*2: About the discharge time setting

If you set the discharge time to 0.0 s or if the voltage between the output terminals exceeds approximately 30 V even after the specified discharge time has passed, the TOS9213S will continue discharging until the voltage between the output terminals falls below approximately 30 V.

### Ammeter

Measurement range	0.00 mA to 5.5 mA DC
Accuracy *3	0µA to 2.00mA: ±(3% of reading + 5µA) 2.01mA to 5.50mA: ±(3% of reading + 10µA)
Response	Mean-value responsive (response time of 200 ms)
Hold function	The measured current at the end of the test is held during the PASS period.

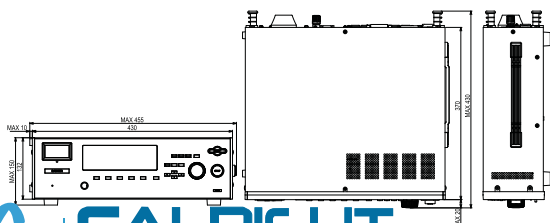
### Judgement function

Setting range for the upper reference (UPPER)	1 µA to 999 µA 1 µA STEP 1.00 mA to 5.50 mA 0.01 mA STEP
Setting range for the lower reference (LOWER)	1 µA to 999 µA 1 µA STEP 1.00 mA to 5.50 mA 0.01 mA STEP (With the LOWER OFF function)
Judgement accuracy *3	0 µA to 2.00 mA: ±(3% of setting + 5 µA) 2.01 mA to 5.50 mA: ±(3% of setting + 10 µA)
Response switching function	The current detection response for UPPER FAIL judgement can be set to FAST/MID/SLOW (*4)
Time	
Setting range for the voltage rise time (RISE TIME)	0.1 s to 200 s
Setting range for the test time (TEST TIME)	0.3 s to 999 s (With the TIMER OFF function)

\*3: When the GND LOW/GUARD setting is set to LOW, the humidity must not exceed 70 % rh.

\*4: In the MID and SLOW modes, depending on the discharge method, the voltage monitoring function may operate and the TOS9213S may enter the PROTECTION status before UPPER FAIL detection takes place.

## External dimensional diagrams



Unit: mm

\*The highlighted text in red indicates the improved specification exclusively applied to the PV module testing.

### Insulation Resistance Tester

Output section		
Output-voltage range	-25 V to -1500 V	
Resolution	1 V	
Accuracy	±(1.5% of setting+2 V)	
Maximum rated load	1 W(-1000 V/1 mA), 0.15 W(-1500 V/0.1 mA)	
Maximum rated current	1 mA	
Ripple	1 kV no-load: 2 Vp-p or less Maximum rated load: 10 Vp-p or less	
Voltage regulation	1% or less [ Maximum rated load no load ]	
Short-circuit current	12 mA or less	
Discharge function	Forced discharge at the end of test (discharge resistance: 25 kΩ)The discharge time can be set to a value from 0.5s to 300 s.(*2)	
Output-voltage monitoring function	If the output voltage exceeds ±(10% of the setting + 50 V), output is cut off and the protection function activates.	
Voltmeter		
Analog	Scale	10 kV DC F.S
	Accuracy	±5% F.S
	Indicator	Mean-value responsive
Digital	Measurement range	0 V to -1700 V
	Resolution	1 V
	Accuracy	±(1.0% of reading + 1 V)
Resistance meter		
Measurement range	0.01 MΩ - 9.99 GΩ (Within the maximum rated current range of 1 mA to 50 mA)	
Accuracy	50 nA ≤ i ≤ 100 nA: ±(20% of reading.) 100 nA < i ≤ 200 nA: ±(10% of reading.) 200 nA < i ≤ 1 µA: ±(5% of reading.) 1 µA < i ≤ 1 mA: ±(2% of reading.) [i=measured current]	
[In the humidity range of 20 % to 70 % R.H (no condensation), with no disturbance such as swinging of the test leadwire]		

### Judgement function

Judgement method	The UPPER/LOWER judgement can be switched between the resistance value-based judgement and current value-based judgement. The action for the judgement method by the current value-based judgement, Display, Buzzer, SIGNAL I/O can be referred to the action in Withstanding Voltage Test Mode.
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Setting range for the upper reference (UPPER)	Resistance value-based judgment	0.01 MΩ to 9.99 GΩ [Below the maximum rated current]
	Current value-based judgment	0.1 µA to 1.00 mA
Setting range for the lower reference (LOWER)	Resistance value-based judgment	0.01 MΩ to 9.99 GΩ [Below the maximum rated current]
	Current value-based judgment	0.1 µA to 1.00 mA

### Time

Setting range for the voltage rise time (RISE TIME)	0.1 s to 200 s
Setting range for the test time (TEST TIME)	0.5 s to 999 s (With the TIMER OFF function)

## General Specifications

Power requirements	Nominal voltage range (Allowable voltage)	100 V to 120 V AC / 200 V to 240 V AC (85 V to 130 V AC / 170 V to 250 V AC) Selectable
Power consumption	Using no load (READY)	100 VA or less
	Using the rated load	Maximum of 200 VA
Allowable frequency range		47Hz to 63Hz
Insulation resistance		30 MΩ or more (500 V DC) [between the AC LINE and chassis]
Withstanding voltage		1390 V AC, 2 seconds, 20 mA or less [between the AC LINE and chassis]
Earth continuity		25 A AC/0.1 Ω or less
Safety		Conforms to the requirements of the following standard. IEC 61010-1 Class 1 Pollution degree 2
Warranty range	Temperature/ Humidity	5°C to 35°C/20% to 80% rh(No condensation)
Operating range	Temperature/ Humidity	0°C to 40°C/20% to 80%rh(No condensation)
Storage range	Temperature/ Humidity	-20°C to 70°C/90 % RH or less (No condensation)
Dimensions(maximum)		430[16.93 inch](455[17.91 inch])W× 132[5.20 inch](150[5.91 inch])H× 370[14.57 inch](430[16.93 inch])Dmm
Weight		Approx. 12 kg (Approx. 26.46 lbs)
Accessory		AC Power cord 1 pc., High-voltage test leadwire TL01-TOS (1.5 m) 1 set, Interlock jumper 1 pc., HIGH VOLTAGE DANGER sticker 1 sheet, Fuse 1pc., Operation Manual 1 copy